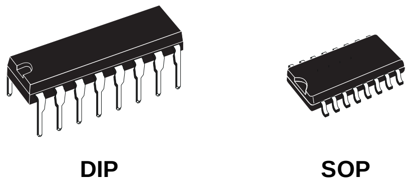
HCF4060B

14-STAGE RIPPLE CARRY BINARY COUNTER/DIVIDER AND OSCILLATOR

- MEDIUM-SPEED OPERATION
- COMMON RESET
- FULLY STATIC OPERATION
- BUFFERED INPUTS AND OUTPUTS
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT I_I = 100nA (MAX) AT V_{DD} = 18V T_A = 25°C
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



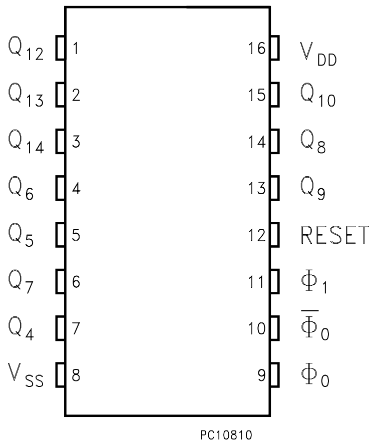
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4060BEY	
SOP	HCF4060BM1	HCF4060M013TR

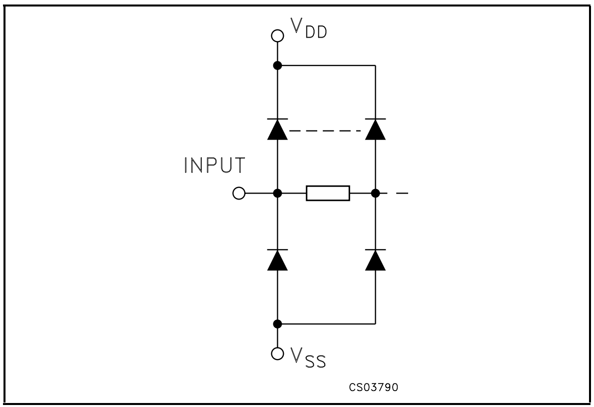
DESCRIPTION

The HCF4060B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.
The HCF4060B consists of an oscillator section and 14 ripple carry binary counter stages.
The oscillator configuration allows design of either RC or crystal oscillator circuits. A RESET input is provided which reset the counter to the all 0's state and disable oscillator. A high level on the RESET line accomplishes the reset function. All counter stages are master slave flip-flops. The state of the counter is advanced one step in binary order on the negative transition of ϕ_1 (and ϕ_0). All inputs and outputs are fully buffered. Schmitt trigger action on the clock pin permits unlimited clock rise and fall time.

PIN CONNECTION



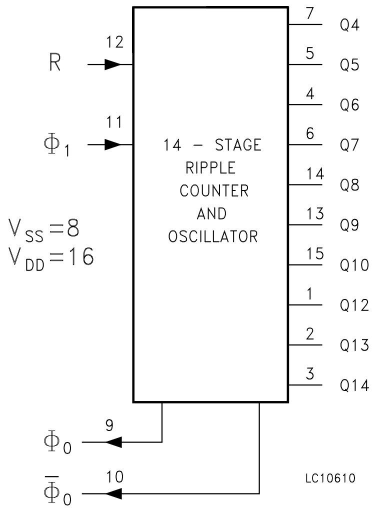
INPUT EQUIVALENT CIRCUIT



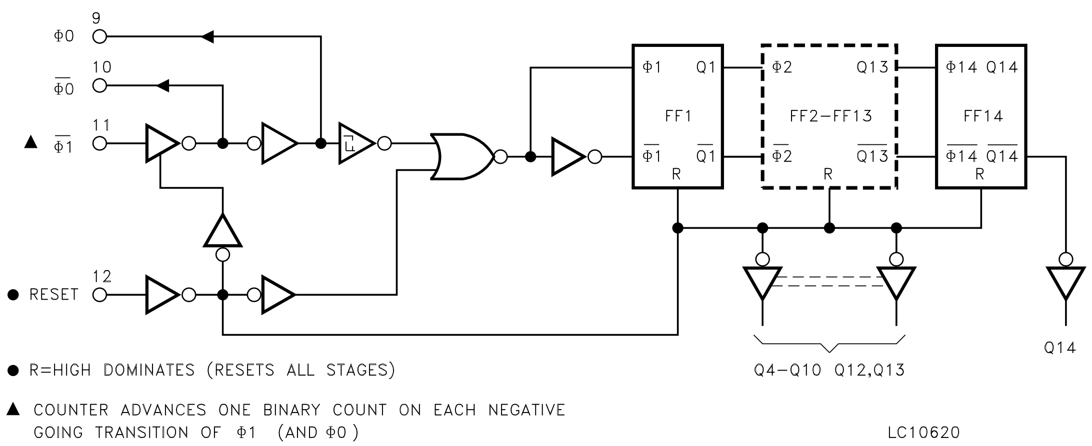
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 2, 3, 4, 5, 6, 7, 13, 14, 15	Q_{12}, Q_{13}, Q_{14}, Q_6, Q_5, Q_7, Q_4, Q_9, Q_8, Q_{10}	Outputs
9, 10, 11	Φ_0, $\overline{\Phi}_0$, Φ_1	Oscillator Input
12	RESET	Reset
8	V_{SS}	Negative Supply Voltage
16	V_{DD}	Positive Supply Voltage

FUNCTIONAL DIAGRAM



LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	-0.5 to +22	V
V_I	DC Input Voltage	-0.5 to V_{DD} + 0.5	V
I_I	DC Input Current	± 10	mA
P_D	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
T_{op}	Operating Temperature	-55 to +125	°C
T_{stg}	Storage Temperature	-65 to +150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.
All voltage values are referred to V_{SS} pin voltage.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{DD}	Supply Voltage	3 to 20	V
V_I	Input Voltage	0 to V_{DD}	V
T_{op}	Operating Temperature	-55 to 125	°C

DC SPECIFICATIONS

Symbol	Parameter	Test Condition				Value							Unit
		V_I (V)	V_O (V)	$\lvert I_O \rvert$ (µA)	V_{DD} (V)	T_A = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent Current	0/5			5		0.04	5		5		150	µA
		0/10			10		0.04	10		10		300	
		0/15			15		0.04	20		20		600	
		0/20			20		0.08	100		100		3000	
V_{OH}	High Level Output Voltage	0/5		<1	5	4.95			4.95		4.95		V
		0/10		<1	10	9.95			9.95		9.95		
		0/15		<1	15	14.95			14.95		14.95		
V_{OL}	Low Level Output Voltage	5/0		<1	5		0.05			0.05		0.05	V
		10/0		<1	10		0.05			0.05		0.05	
		15/0		<1	15		0.05			0.05		0.05	
V_{IH}	High Level Input Voltage		0.5/4.5	<1	5	3.5			3.5		3.5		V
			1/9	<1	10	7			7		7		
			1.5/13.5	<1	15	11			11		11		
V_{IL}	Low Level Input Voltage		4.5/0.5	<1	5			1.5		1.5		1.5	V
			9/1	<1	10			3		3		3	
			13.5/1.5	<1	15			4		4		4	
I_{OH}	Output Drive Current	0/5	2.5	<1	5	-1.36	-3.2		-1.15		-1.1		mA
		0/5	4.6	<1	5	-0.44	-1		-0.36		-0.36		
		0/10	9.5	<1	10	-1.1	-2.6		-0.9		-0.9		
		0/15	13.5	<1	15	-3.0	-6.8		-2.4		-2.4		
I_{OL}	Output Sink Current	0/5	0.4	<1	5	0.44	1		0.36		0.36		mA
		0/10	0.5	<1	10	1.1	2.6		0.9		0.9		
		0/15	1.5	<1	15	3.0	6.8		2.4		2.4		
I_I	Input Leakage Current	0/18	Any Input		18		$\pm 10^{-5}$	±0.3		±0.3		±1	µA
C_I	Input Capacitance		Any Input				5	7.5					pF

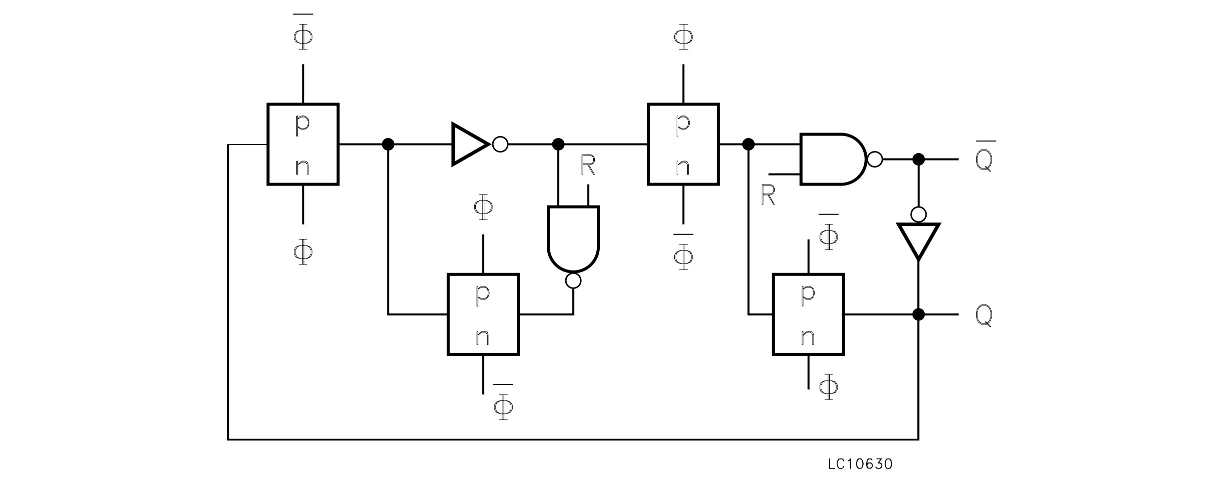
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, R_L = 200KΩ, t_r = t_f = 20 ns)

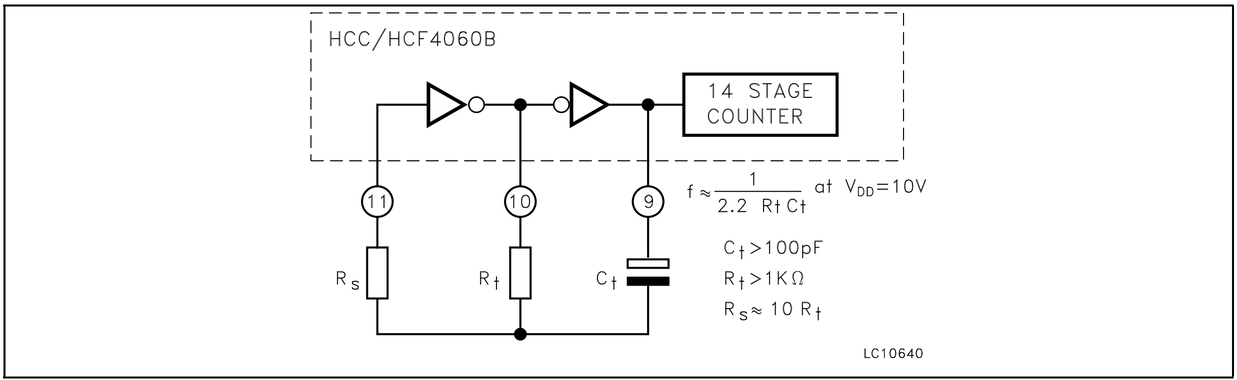
Symbol	Parameter	Test Condition		Value (*)			Unit
		V_{DD} (V)		Min.	Typ.	Max.	
t_{TLH} t_{THL}	Output Transition Time	5			100	200	ns
		10			50	100	
		15			40	80	
t_{PLH} t_{PHL}	Propagation Delay Time (φ to Q_4 out)	5			370	740	ns
		10			150	300	
		15			100	200	
t_{PLH} t_{PHL}	Propagation Delay Time (Q_n to Q_{n+1})	5			100	200	ns
		10			50	100	
		15			40	80	
t_W	Input Pulse Width	5	f = 100 KHz		50	100	ns
		10			20	40	
		15			15	30	
t_r t_f	Input Pulse Rise and Fall Time	5		Unlimited			µs
		10					
		15					
f_{max}	Maximum Clock Input Frequency	5		3.5	7		MHz
		10		8	16		
		15		12	24		
RESET OPERATION							
t_{PHL}	Propagation Delay Time	5			180	360	ns
		10			80	160	
		15			50	100	
t_W	Input Pulse Width	5			60	120	ns
		10			30	60	
		15			20	40	
RC OPERATION							
	Variation of Frequency (Unit-to-Unit)	5	C_X= 200pF, R_S= 560KΩ, R_X= 50KΩ	18	21.5	25	KHz
		10		20	23	26	
		15		21.1	24	27	
	Variation of Frequency With Voltage Change (Same Unit)	5 to 10	C_X= 200pF, R_S= 560KΩ, R_X= 50KΩ			2	KHz
		10 to 15				1	
R_X		5	C_X= 10µF			20	MΩ
		10	C_X= 50µF			20	
		15	C_X= 10µF			10	
C_X		5	R_X= 500KΩ			1000	µF
		10	R_X= 300KΩ			50	
		15	R_X= 300KΩ			50	
	Maximum Oscillator Frequency (**)	10	R_X= 5KΩ, C_X= 15pF	530	650	810	KHz
		15		690	800	940	

(*) Typical temperature coefficient for all V_{DD} values is 0.3%/°C, all input rise and fall times= 20 ns.
(**) RC Oscillator applications are not recommended at supply voltages below 7V for R_X < 50KΩ

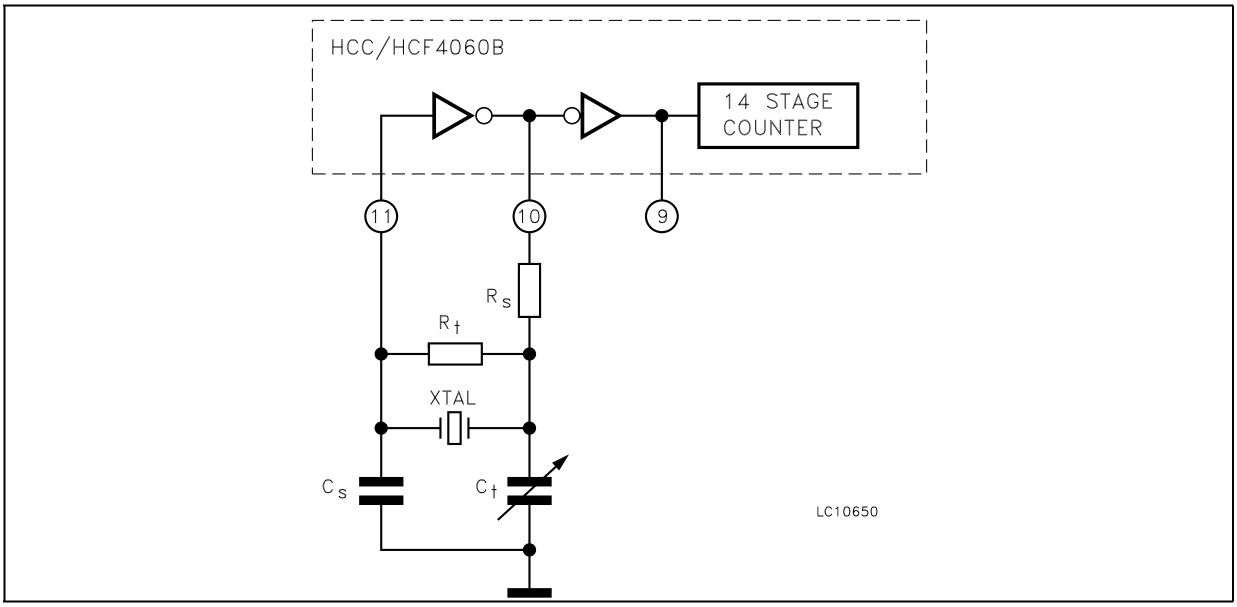
DETAIL OF TYPICAL FLIP-FLOP STAGE



TYPICAL RC OSCILLATOR CIRCUIT

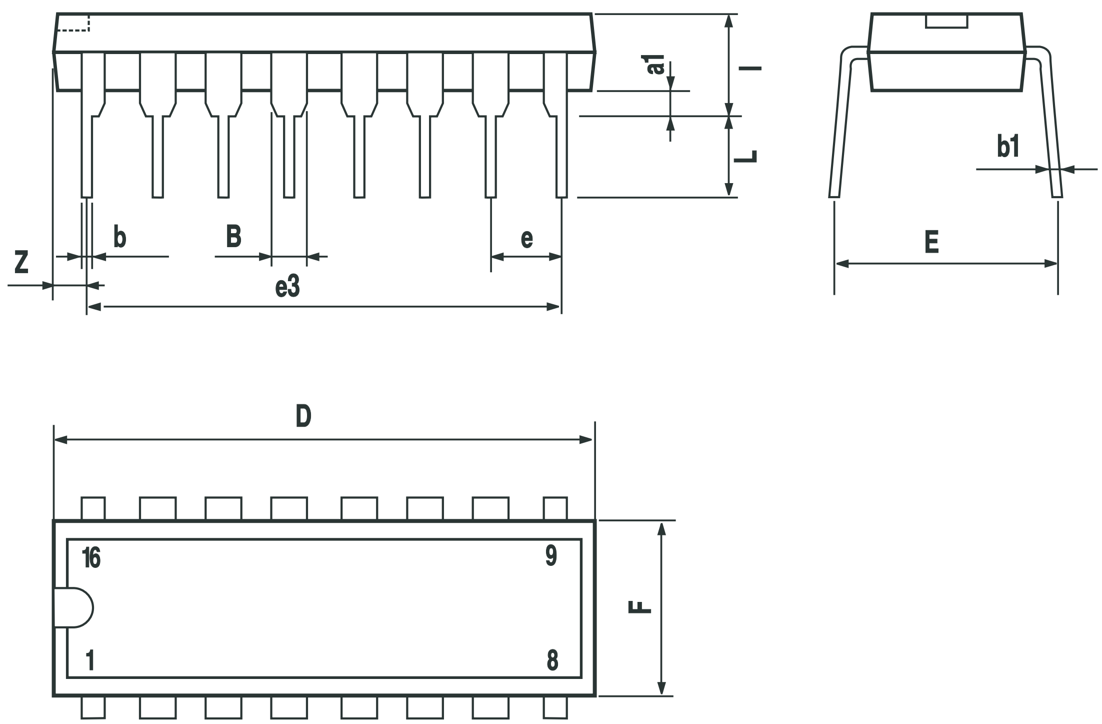


TYPICAL CRYSTAL OSCILLATOR CIRCUIT



Plastic DIP-16 (0.25) MECHANICAL DATA

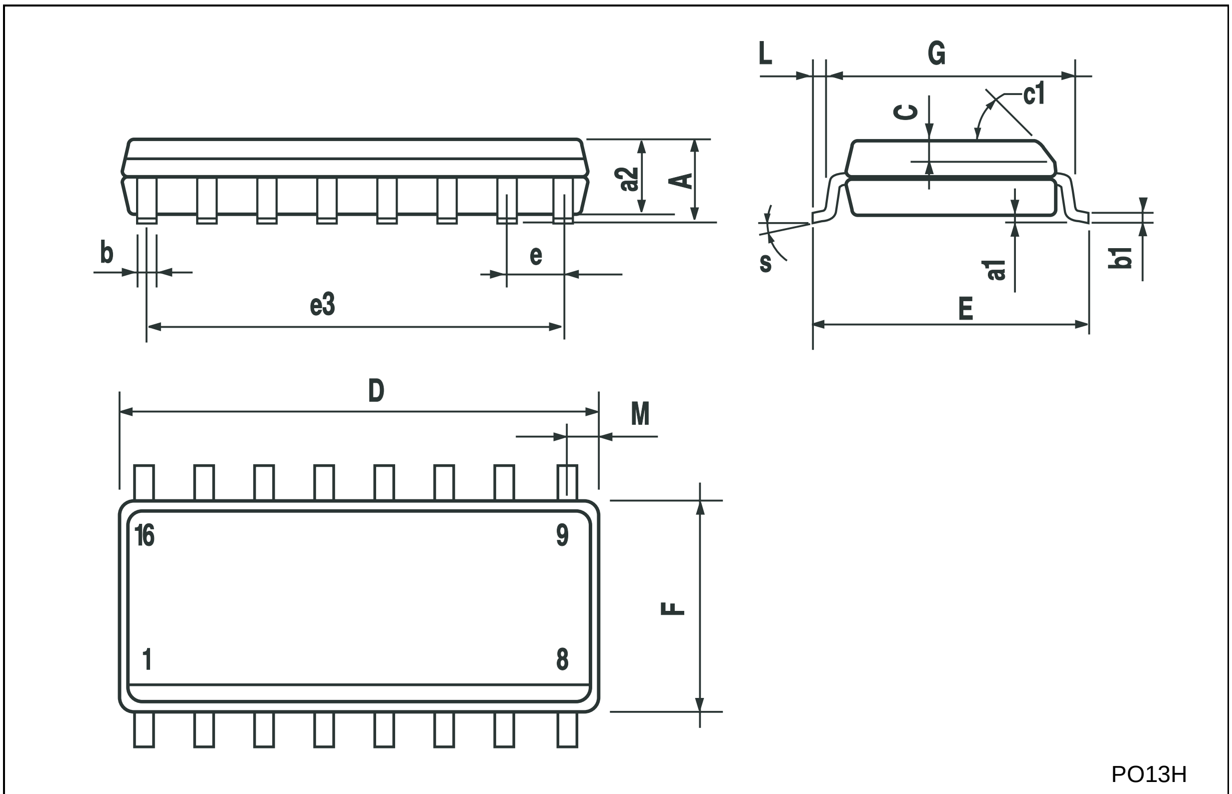
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

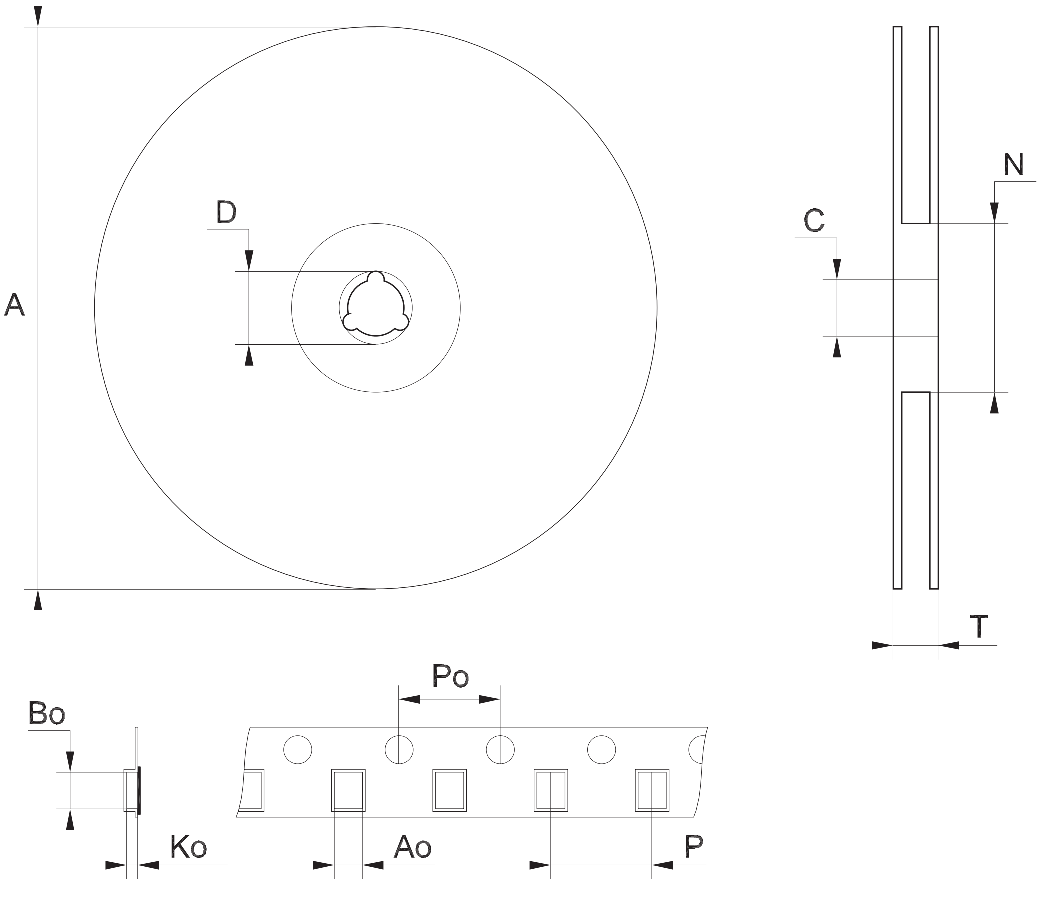
SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.008
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



Tape & Reel SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



Note: Drawing not in scale